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TITLE: Visualizing Logistics

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Visualizing Logistics

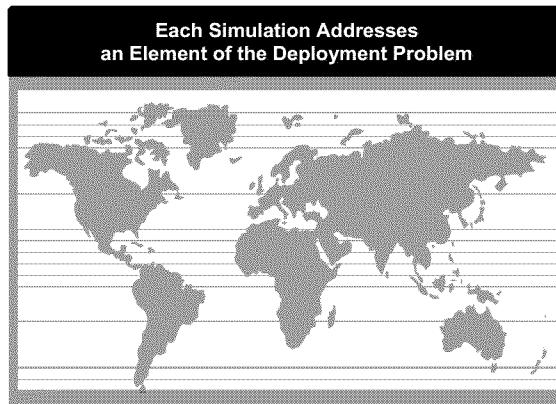
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Logistics processes can be divided into two categories: deployment and sustainment. Both categories generate huge and dynamic datasets that are difficult to comprehend without visualization products. My remarks will address deployment because that is where Argonne National Lab has placed its greatest effort with the simulations shown here.

Deployment can be viewed as a network flow conducted sequentially in three distinct stages, each of which generates its own oversupply of data to comprehend. The three stages consist of gathering or marshalling the force from its predeployment locations to ports of debarkation, movement of the force from ports of embarkation to ports of debarkation and then movement of the force from of debarkation to where needed. Simplistically, this can be called fan-in, transport and fan-out. All three stages are active simultaneously in a fully launched deployment, requiring reuse of assets and steady flow through transfer nodes.



Units are moved according to a detailed plan called the Theater Prioritized Force Deployment List, or TPFDL. This sort of planning assures elements needed arrive in the order needed, e.g., stevedores precede ground transport. Each small unit consists of many piece-parts that must be accumulated and loaded for ground movement to port. That transport and loading format is typically different than normal movement in combat and certainly different than that required for intra-theater transport. Thus, the many piece-parts may have to be repackaged at each transport change node. Each of these introduces a different set of delays and thus a massive dataset that ultimately represents the whole process.

Very complex process models have accumulated for each type of unit, each type of transport and the transfer at each of the major transfer nodes [including home station]. These drive the constructive simulations. Note that these process models are dependent on a very large database and are sufficiently complex that real life anomalies in the process

or process input data are far more apparent in the cumulative effects than when observed directly.

An example may illustrate the importance of comprehending the net cumulative effect. Suppose two ships are intended to load simultaneously at the same port, but the crane loading one of them is out of service for half a day hours causing delay in loading one of the ships. This may delay sailing of that ship and alter the sequence in which their cargos arrive, conceivably delaying the shipment of forklifts intended to unload the dock area at the destination. A subsequent sea movement model may show that a tidal window has been missed, exacerbating the delay. The forklifts may be critical for other shipments arriving from other ports of debarkation, and so on.

The ELIST constructive simulation develops the time-phased movement of forces from origins to destinations over this infrastructure network to determine how long the movements would take and to identify the potential bottlenecks. Flow is constricted by constraints imposed by the infrastructure (capacities of roads and rail links, nodes) and by the movements of assets available over time.

The kinds of information one can get out of the model include statistics on link utilization and asset utilization over time, and the arrival times of all units to destinations, shown here with comparison with the required arrival times

The final slide begins to show the purpose and extent of force projection modeling. Remember that each of the simulations is the aggregation of many process models. Currently, visualization of results is confined to macro unit flow. The complexity of the simulations makes them very useful for planning, but entirely cumbersome for execution. It would be highly beneficial to visualize the overall flow in a way that tied back to the source of observed perturbations, and did so with machine execution speeds that would support near real time management of available assets under changing conditions.

Discussion – Paper 12

Analytic engines could be used to automate logistic planning when it is a rule-based system. Although automation does not appear to be a priority for the services, many companies are utilizing planning tools for daily planning cycles that are similar and may be useful.

Many similarities in logistic planning and mission planning. It may be useful to allow the operator to make the decisions as he knows the domain. For example, the Master Battle Planner shows the user the consequences and the operator makes the decisions.

If the system is very rule based, would it be enough to know if there are deviations from the plan. The visualisation could concentrate on the context to demonstrate what is happening and if changes are needed. It sounds like a control model. You need the data on what is actually happening in order to make the changes that will then affect other operations and situations.

Often the things that go wrong are really unexpected. For example, an engineering company all gets sick with an unidentified ailment and is unable to bridge a flooded river.